A2 Cnd

The magnetic flux shutter 10b is mounted to a rotary shaft of an object to be detected (not show in the figure), and it rotates conjunctly with a member 10a under measurement. As the magnetic flux shutter 10b moves in its circumferential direction, magnetic flux of the magnet 1 that reaches the magnetic sensor element 4 changes its density. This change of density of the magnetic flux is output as an output signal by the magnetic sensor element 4, and the output signal is then output to a computer or the like through the lead terminal 8 and the connector terminal 7, to detect a rotating angle of the member 10a under measurement.

Specification at page 4, line 7:

A3

Fig. 2 is a sectioned side view of the non-contact type position sensor shown in Fig. 1;

Specification at page 12, line 12:

A4

In Fig. 11 through Fig. 13, a first magnet 61 is fixed on its N-pole 62 to an inner surface of an one-side arm of a U-shaped magnetic body 67, in a manner to face a second magnet 64. The second magnet 64 is fixed on its S-pole 66 to an inner surface of an another-side arm of the magnetic body 67. In this exemplary embodiment, the first magnet 61 disposed to the one-side arm of the magnetic body 67 and the second magnet 64 disposed to the another-side arm of the magnetic body 67 are in a perpendicular arrangement with respect to lines of magnetic force, because the magnetic body 67 is U-shaped. Since this increases the lines of magnetic force that flow in the magnetic circuit, it provides for an effect of improving output sensitivity of the non-contact position sensor.

Specification at page 14, line 10:

A5

In Fig. 14, the rotary shaft 78 of the object to be detected is inserted into the cylindrical portion 75 of the case 73. The rotary shaft 78 is provided at its distal end with a semicircle portion 79 having a semicircular shape in cross section. The semicircle portion 79 is positioned within the space 76 formed among the magnetic sensor element 68, the magnet 61, and another magnet 64. In this condition, a lateral distance between the magnet 61 and the magnet 64 is generally matched to a diameter of the rotary shaft 78, in this exemplary embodiment. Since this avoids any of the lines of magnetic force from passing through a space not occupied by the rotary shaft 78 between the magnet 61 and the magnet 64, thereby providing for an effect of improving an output characteristic of the non-contact position sensor.

Specification at page 15, line 28:

A6 cont

In Fig. 17, a first magnetic body 111 having a shape of letter U is provided with a first magnetic-detecting portion 113 on an upper surface at an intermediate portion 112, and a first projecting portion 114 projecting upward on this first magnetic-detecting portion. A first magnet 116 having a principal ingredient of SmCo, for instance, is fixed on its N-pole 117 to an upper surface of one-side arm 111a of the magnetic body 111, and a second magnet 118 having a principal ingredient of SmCo is fixed on its S-pole 119 to an another-side arm 111b of the magnetic body 111. A second magnetic body 120 having a shape of letter U has an S-pole 121 of the magnet 116 fixed to a lower surface of its one-side arm 120a, and an N- pole 122 of the magnet 118 fixed to a lower surface of its other side 120b. The second magnetic body 120 is also provided on a lower surface at an intermediate portion 123 with a second magnetic-detecting portion 124 in a manner to confront the first magnetic-detecting portion 113. Further, the second magnetic-detecting portion 124 is provided with a second projecting portion 125 projecting downward, and a recessed portion 126 on the other side of the projecting portion 125. Similarly, there is another recessed portion (not show in the figure) provided on the other side of the first projecting portion 114. A magnetic sensor element 127 is disposed between the first magnetic-detecting portion 113 and the second magnetic-detecting portion 124.

Specification at page 16, line 30:

Next, adhesive is applied to an upper surface of the one-side arm 111a and a lower surface of the another-side arm 111b of the magnetic body 111, the magnet 116 is fixed on its N-pole 117 to the upper surface of the one-side arm 111a, and the magnet 118 is fixed thereafter on its S-pole 119 to the another-side arm 111b.

Specification at page 17, line 1:

In this exemplary embodiment, since the projecting portion 125 is formed with drawing process and the recessed portion 126 on the another-side arm of the projecting portion 125, there is not lines of magnetic force originating from the magnet 116 and the magnet 118 to pass through the recessed portion 126, and thereby the lines of the magnetic force concentrate in the second magnetic-detecting portion 124. This increases lines of the magnetic force that pass through the magnetic sensor element 127, increases sensitivity of an output delivered from the output terminal 129 of the magnetic sensor element 127, and improves an output characteristic of the

A8 End

non-contact position sensor.

Specification at page 18, line 6:

A9

When rotating angle of the object 133 being detected is 50 degrees, the semicircular portion 131 locates in such an orientation that is perpendicular to both the magnet 116 and the magnet 118, as shown in Fig. 18(b), and the lines of magnetic force hardly flow into the object 133 being detected. At this moment, the lines of magnetic force originating from the N-pole 117 of the magnet 116 loop in a way that they are introduced from the one-side arm 111a to the another-side arm 111b of the magnetic body 111, pass through the S-pole 119 and the N-pole 122 of the magnet 118, proceed from the another-side arm 120b to the one-side arm 120a of the magnetic body 120, and return to the S-pole 121 of the magnet 116. As a result, the lines of magnetic force do not pass through the magnetic sensor element 127. At this time, output voltage at the output terminal 129 of the magnetic sensor element 127 becomes approx. 2.5V, as shown in Fig. 19.

Specification at page 18, line 21:

A10 cont

At this moment, the lines of magnetic force originating from the N-pole 122 of the magnet 118 return to the S-pole 119 of the magnet 118 via the another-side arm 120b of the magnetic body 120 and further through the semicircular portion 131 and the another-side arm 111b of the magnetic body 111. On the other hand, the lines of magnetic force originating from the N-pole 117 of the magnet 116 pass through the one-side arm 111a and the magnetic-detecting portion 113 of the magnetic body 111, and into the magnetic sensor element 127 upwardly from its lower side, and return to the

A10 End

S-pole 121 of the magnet 116 through the magnetic-detecting portion 124 and the one-side arm 120a of the magnetic body 120. At this time, output voltage at the output terminal 129 becomes approx. 4.3V, as shown in Fig. 19.

[Specification at page 24, line 5:]

A11

First, the projecting portion 213, projecting inwardly, and the recessed portion 214 are formed with drawing process in generally the center portion of the sensor element supporting portion 212 of the first magnetic body 211, which is prefabricated in the shape of letter U.

Specification at page 24, line 9:

In this embodiment, since the recessed portion 214 is formed on the another-side arm of the projecting portion 213, there is not lines of magnetic force originating from the magnet 218 and the magnet 219 to pass through the recessed portion 214, and thereby the lines of the magnetic force concentrate in the tip end of the projecting portion 213. This further increases lines of the magnetic force that pass through the magnetic sensor element 215, thereby increasing furthermore the sensitivity of output signals produced by the magnetic sensor element 215.

Specification at page 25, line 34:

A12 cont

In other words, the lines of the magnetic force pass through the magnetic sensor element 215 from the object 225 to the projecting portion 213, in the state that the semicircular portion 228 locates in the vicinity of the magnet 218, whereas the lines of magnetic force pass through the magnetic sensor element 215 from the projecting portion 213 to the object 225, in the state that the semicircular portion 228 locates in the vicinity of the magnet 219. Therefore, as the object 225 rotates, output signal shown in Fig. 27 is output in response to the rotating angle. This output signal is input to a computer or the like (not show in the figure) to measure the rotating angle of the object 225 being detected.

Specification at page 28, line 5:

In Fig. 30 and Fig. 31, a first magnetic body 311 having a shape of letter U is provided with a first magnetic-detecting portion 313 on an upper surface at an intermediate portion 312, and a first projecting portion 314 projecting upward on the magnetic-detecting portion 313. There also is a recessed portion 315 provided on the other side of the first projecting portion 314. A first magnet 316 having a principal ingredient of SmCo, for instance, is fixed on its N-pole 317 to an upper surface of an one-side arm 311a of the magnetic body 311, and a second magnet 318 having a principal ingredient of SmCo is fixed on its S-pole 319 to an another-side arm 311b of the magnetic body 311. A second magnetic body 320 having a shape of letter U has an S-pole 321 of the magnet 316 fixed to a lower surface of its one-side arm 320a, and an N- pole 322 of the magnet 318 fixed to a lower surface of its another-side arm 320b. The magnetic body 320 is also provided on a lower surface at an intermediate portion 323 with a second magnetic-detecting portion 324 in a manner to confront the magnetic-detecting portion 313 of the magnetic body 311. Further, the magnetic-detecting portion 324 of the magnetic body 320 is provided with a second projecting portion 325 projecting downward, and a recessed portion 326 on the other side of the projecting portion 325. A magnetic sensor element 327

A13 End

is held between the magnetic-detecting portion 313 and the magnetic-detecting portion 324.

Specification at page 30, line 30:

A14

Here, the width of the one-side arm 311a is denoted by A, the space between the one-side arm 311a and the another-side arm 311b is denoted by B, the width of the another-side arm 311b is denoted by C, and a length of the detective section 332 is denoted by D, as shown in Fig. 32(a). It is also assumed that a move position of the object 331 to be detected is 0mm, when the center point of the detective section 332 situates at an intermediate point of the space between the one-side arm 311a and the another-side arm 311b.

Specification at page 31, line 1:

A15 Cont

First, when one end of the detective section 332 by the another-side arms is located at a position in line with one end of the another-side arm 311b, that is, when the detective section 332 is in a position of - (C + B / 2 - D/2) mm, the detective section 332 is located in the vicinity of the magnet 318, which is furthest from the magnet 316. At this moment, lines of magnetic force originating from the N-pole 322 of the magnet 318 returns to the S-pole 319 of the magnet 318 via the another-side arm 320b of the magnetic body 320, the detective section 332, and the another-side arm 311b. Also, lines of magnetic force originating from the N-pole 317 of the magnet 316 pass from the magnetic-detecting portion 313 to the magnetic sensor element 327 via the one-side arm 311a, reach the magnetic-detecting portion 324, and return to the S-pole 321 of the magnet 316 through the one-side arm

320a. At this time, an output voltage at the output terminal 329 of the magnetic sensor element 327 becomes approx. 0.7V, as shown in Fig. 33.

Specification at page 31, line 21:

Furthermore, when the detective section 332 is in the 0mm position, i.e. the detective section 332 is located at an equal distance from both the magnet 316 and the magnet 318, an as shown in Fig. 32(b), lines of the magnetic force into the detective section 332 are cancelled out. At this moment, the lines of magnetic force originating from the N-pole 317 of the magnet 316 loop in a way that they are introduced from the one-side arm 311a to the another-side arm 311b (not show in the figure), proceed from the another-side arm 320b to the one-side arm 320a via the S-pole 319 and the N-pole 322 of the magnet 318, and return to the S-pole 321 of the magnet 316. At this moment, there is no line of the magnetic force passing through in the magnetic sensor element 327. And, output voltage from the output terminal 329 becomes approx. 2.5V, as shown in Fig. 33. Furthermore, when the detective section 332 moves to a position of (A + B / 2 – D / 2) mm, the detective section 332 is located in the vicinity of the magnet 316, as shown in Fig. 32(c). At this moment, lines of magnetic force originating from the N-pole 317 of the magnet 316 return to the S-pole 321 of the magnet 316 through the one-side arm 311a, the detective section 332, and the one-side arm 320a. Also, lines of magnetic force originating from the N-pole 322 of the magnet 318 are guided through the another-side arm 320b and the magnetic-detecting portion 324, passes the magnetic sensor element 327 downward from the upper side, and return to the S-pole 319 of the magnet 318 via the magnetic-detecting portion 313 and the another-side arm 311b. At this time, output voltage from the output terminal 329 becomes